

(21) Application No 9202499.1

(22) Date of filing 06.02.1992

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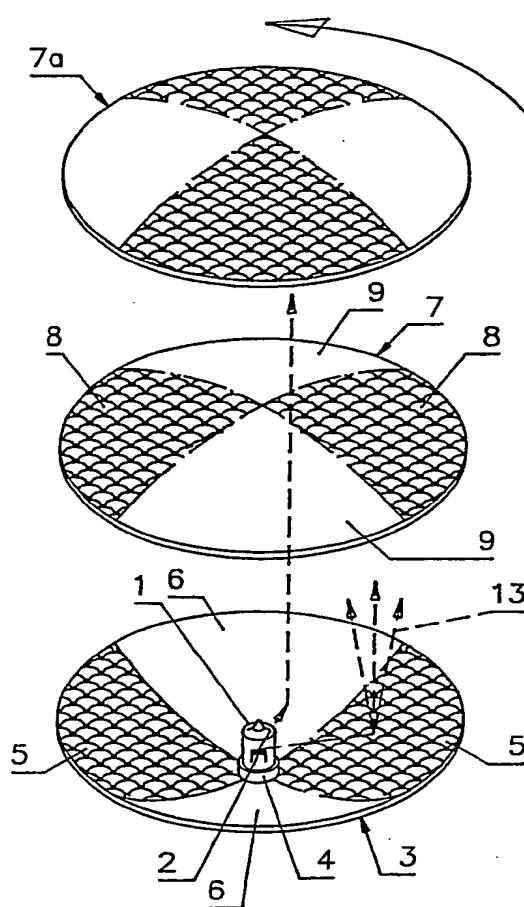
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(51) INT CL<sup>s</sup>  
F21L 15/02, F21V 13/06(52) UK CL (Edition L)  
 F4R RCAA RCC R254 R41Y R410 R631 R646  
 R647 R65Y R655 R671 R69Y R695  
 U1S S1930(56) Documents cited  
None(58) Field of search  
 UK CL (Edition K) F4R RCAA RCC  
 INT CL<sup>s</sup> F21L 15/02, F21V 13/06

## (54) Lamp

(57) A lamp is able to be converted from a floodlight (wide angle) configuration to a spotlight (narrow beam) configuration by rotation of a lens (7) divided into four quadrants of which two opposite quadrants (8) are dimpled and the other two opposite quadrants (9) are unmodified.

The reflector, or a cover plate for the torch is similarly divided into four quadrants of which two opposite quadrants (5) are dimpled and the other two intervening opposite quadrants (6) are unmodified.

Figure 1

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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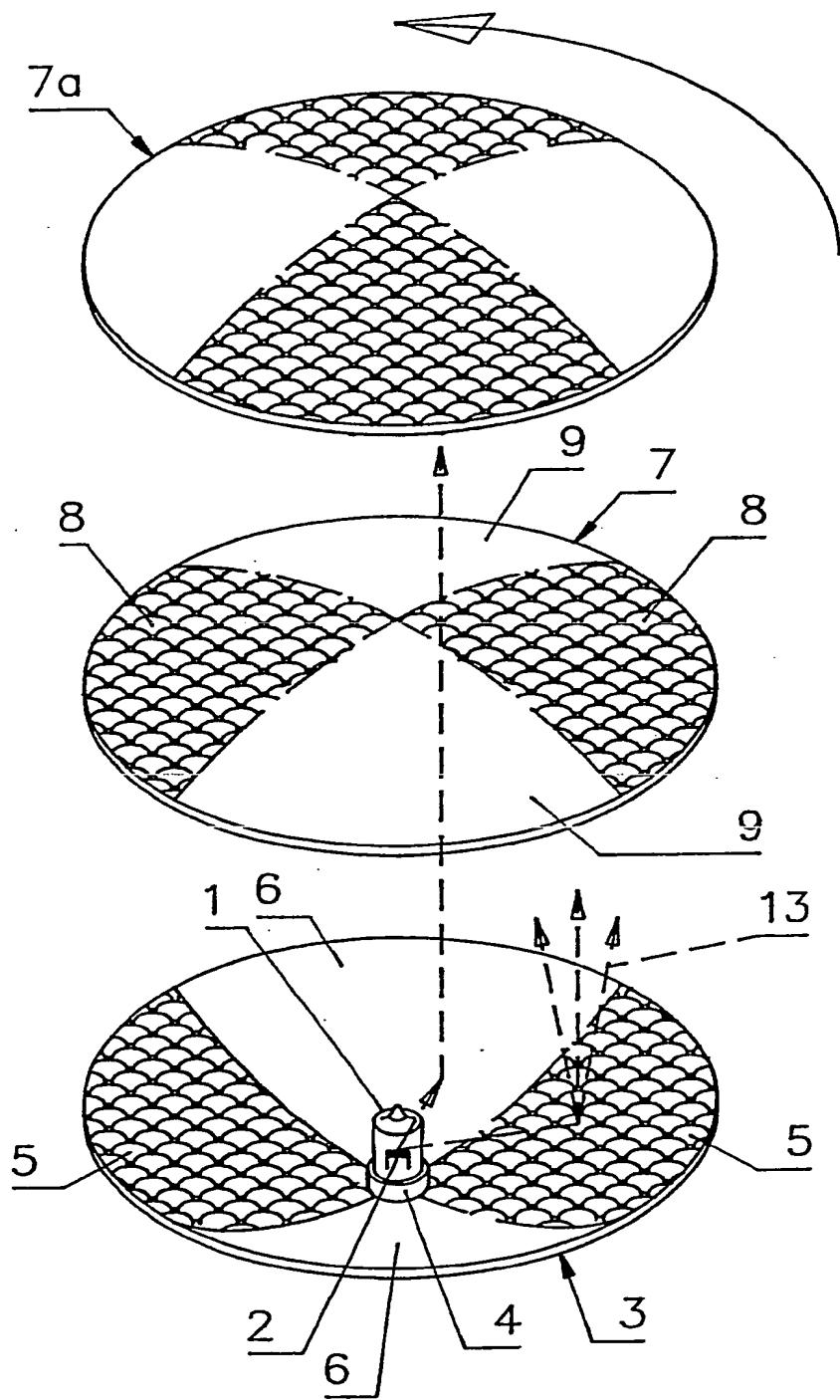


Figure 1

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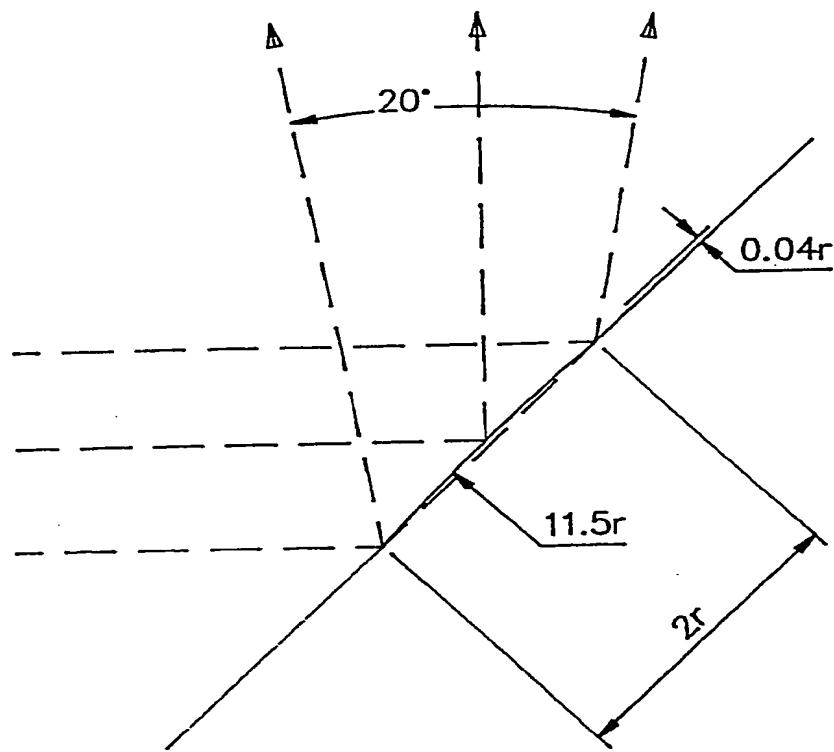


Figure 2a

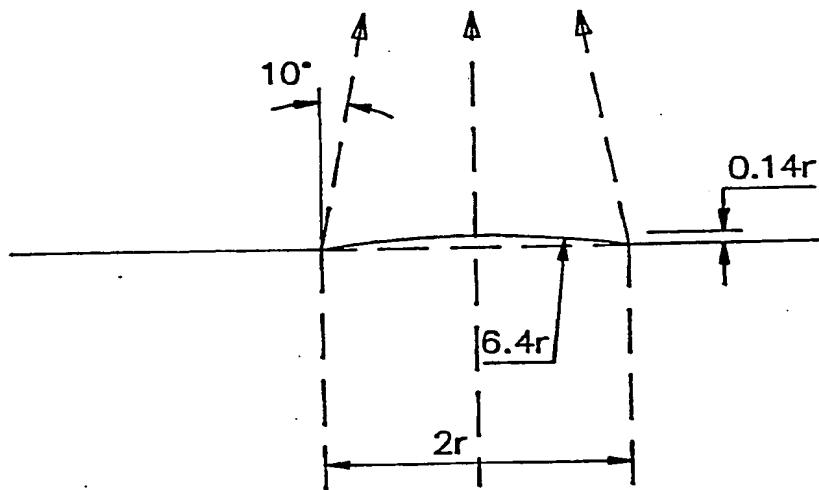


Figure 2b

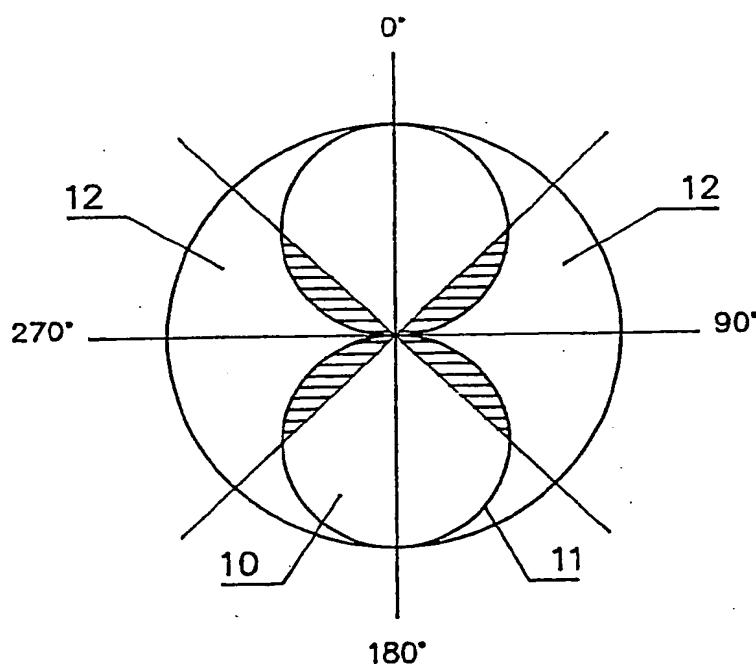


Figure 3a

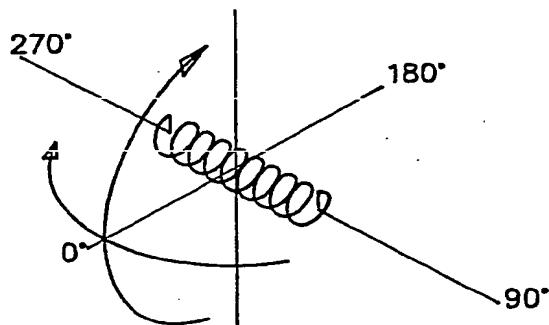


Figure 3b

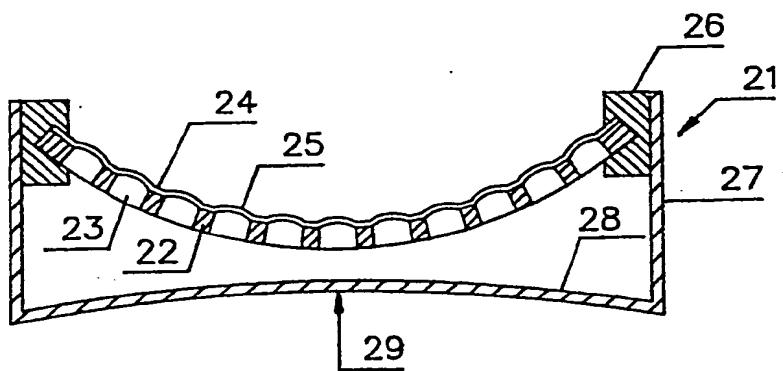


Figure 4

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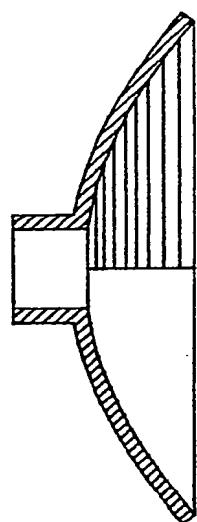


Figure 5a

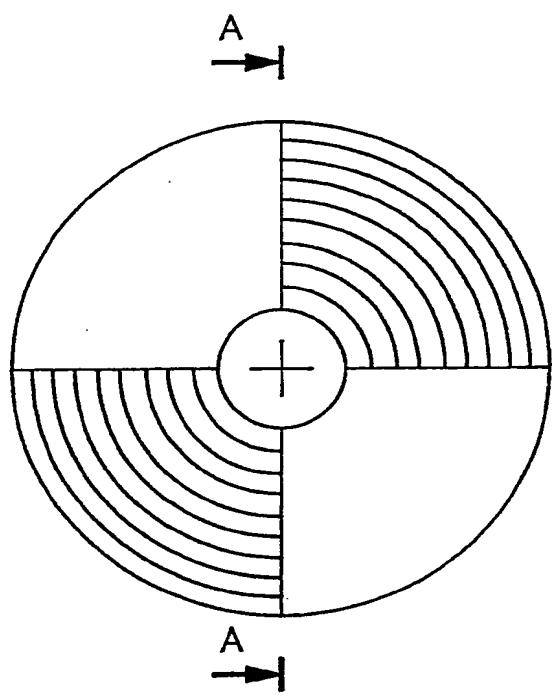


Figure 5b

- 1 -

LAMP

The present invention relates to a lamp able to give an adjustable confined beam, and to lens or a reflector for such a lamp.

5 It is known to provide for various different types of lamp beams by appropriate design of the configuration of the reflector, so that on the one hand a very close "spotlight" type of beam having an included angular spread of the order of 1° can be achieved, and on the other hand a wide 10 angle "floodlight" type of beam having an angular spread of, say, 60° is possible.

With the conventional wide angle configuration, a battery lamp having a lamp bulb with a power of 2.5 watts (38 lumens) a 64° spread will give an intensity of no more 15 than 19 candelas. With no containment of the beam at all the luminous intensity of the 2.5 watt bulb would be 3 candelas and with confinement to a 1° divergence the light intensity will be of the order of 500,000 candelas.

It is an object of the present invention to provide 20 a lamp which allows rapid and simple conversion from the confined beam (spotlight) configuration to a wide angle (floodlight) configuration while allowing optimum light intensity in both configurations.

It is a further object of the present invention to 25 allow such a system to be built into a safety lamp in which the body may be substantially sealed in order to provide minimum fire hazard and to allow the torch to be used in a wet environment.

The present invention also provides a novel 30 reflector for such a lamp.

Accordingly, one aspect of the present invention provides a reflector for a lamp, comprising a body of revolution having a concave face shaped to define an optical reflector, and profiling interrupting said concave face and 35 able to diffuse the reflected light along divergent paths.

In one preferred form said profiling is variable in shape for varying the degree of diffusion of the reflected light.

5 In another preferred form said body of revolution is divided into four segments, with two opposed segments having said profiling to diffuse the reflected light along divergent paths, and the two intervening segments without such profiling.

10 A second aspect of the present invention provides a lens or front plate for a lamp, divided into four segments with opposing segments profiled to diffuse the refracted light passing through the lens to give a divergent beam, and the two intervening segments without such profiling.

15 A third aspect of the present invention provides means for varying the profiling of said body of revolution.

A further aspect of the invention provides a lamp:-  
including a lamp holder for a bulb; a reflector surrounding  
said bulb holder and divided into four segments of which two  
opposing segments are profiled to diffuse light from the  
20 bulb being reflected by the reflector, and the other two  
segments being without such profiling; a lens or plate  
through which the light from the reflector passes, said lens  
or plate being divided into four segments corresponding to  
the segments of the reflector, two of said segments of the  
25 lens or plate being profiled to diffuse light passing  
therethrough to generate a divergent beam, and the other two  
intervening segments being without such profiling; and  
means allowing said lens to be rotated relative to the axis  
of symmetry of said reflector and relative to said reflec-  
30 tor.

Yet a further aspect of the invention provides a lamp, comprising a reflector and a lens, wherein the light path includes reflection by or transmission through two members each having profiling which interrupts the face of  
35 the member and is able to diffuse the light along divergent paths, means being provided for establishing relative

rotation between said two members to bring their respective profilings into and out of register.

In order that the present invention may more readily be understood the following description is given, 5 merely by way of example, with reference to the accompanying drawings, in which:-

FIGURE 1 is an exploded view of the torch bulb, reflector, and front lens, of a torch in accordance with the present invention, the reflector itself being in accordance 10 with the invention;

FIGURE 2a is a large scale view of a dimple in the reflector of Figure 1, consistent with a 20° angular spread of beam;

FIGURE 2b is a view to the same scale as Figure 2a 15 but showing schematically a dimple in the front lens (refractor) to give a 20° divergence of beam;

FIGURE 3a is a diagram showing the angular distribution of light emission from a coiled filament of a lamp bulb;

20 FIGURE 3b is a diagram showing the orientation of the filament relative to the axes shown in Figure 3a;

FIGURE 4 is a schematic view of an alternative form of torch in accordance with the present invention;

FIGURE 5a shows a transverse sectional view of a 25 reflector having a plurality of arcuate flutes as the profiling, the section being taken on the line A-A of Figure 5b; and

FIGURE 5b shows a front elevational view of the reflector of Figure 5a.

30 As shown in Figure 1, the lamp bulb 1 has the axis of its coiled filament 2 running from right to left in the drawing. The lamp illustrated is a halogen-filled quartz envelope lamp.

The reflector 3 is rotatable relative to the bulb 35 holder 4 and is divided into four segments, in this case quadrants, of a circle of which two opposite segments 5 are

dimpled on the front surface, in a manner to be described later, and the remaining two opposite segments 6 are unmodified (i.e. they have an undimpled reflective front surface, for example parabolic) which is designed to give  
5 the optimum focusing of the beam in the spotlight configuration.

Over the mirror 3 is a front lens 7 or plate having four segments, in this case quadrants, of which two opposite segments 8, superimposed on the dimpled segments 5 of the  
10 reflector 3, are themselves dimpled on the front surface, and the remaining two opposite segments 9 are unmodified.

The configuration of the lamp filament 2 is such that, as shown in Figure 3a, there will be a greater intensity of the emitted light from the filament along  
15 directions extending laterally of the axis of its filament coil than along the directions substantially axially of that axis.

Figure 3a is a view looking along the axis of the torch (i.e. the axis of the globe of the lamp bulb) and the  
20 unshaded area 10 within the circles 11 shows a region in which in the case of an ideal filament 80% of the emitted light occurs. This is in fact a solid figure of "diabolo-shaped" configuration between two end cones 12 coaxial with the lamp filament coil axis, one at each end of the filament  
25 coil axis and arranged apex to apex.

Approximately 60% of the emitted light occurs in the diabolo-shaped region 10.

By arranging the reflector relative to the filament axis in the Figure 1 configuration, the much more intense  
30 light emitted in the diabolo-shape 10 of Figure 3a will either pass straight through the lens or plate 7 for those parts of the diabolo extending forwardly away from the reflector, or be reflected by the unmodified segments 6 of the reflector 3 to pass forwardly of the torch through the  
35 unmodified segments 9 of the front lens or plate 7.

This will allow for a high intensity beam which can

be focused, as a result of the shape of the reflector to give the best optical characteristics.

The 18% of the light emitted into the end cones 12 of Figure 3a will fall on the dimpled quadrants 5 of the reflector and will then be diffused by the dimpling of the reflector but generally passed forwardly of the torch through the juxtaposed dimpled quadrants 8 of the front lens where the light will again be subject to diffusion, but this time by refraction. The effect of the diffusion by the 10 dimples of both the reflector quadrants 5 and the quadrants 8 of the front lens or plate 7 will be to provide a wide angle but low intensity component to the emitted light pattern but, because the amount of light involved in this emission is such a small proportion of the total emission 15 from the lamp, the perceived beam is effectively the 1° divergence spotlight beam.

If now the front lens or plate 7 is rotated to the alternative position 7a shown in Figure 1, the relatively high intensity light emitted in the diabolo-shaped region 10 of Figure 3a and incident on the unmodified reflector quadrants 6 of Figure 1 will pass forwardly by being refracted at the dimples in the front lens or plate 7 to diverge to form a wide angle beam of, say, 20° divergence angle.

Likewise, the lower intensity portion of the light emitted in the cones 12 of Figure 3a will be diffused, as represented by the arrows 13 in Figure 1 but in that divergent configuration they will pass straight through the unmodified quadrants 9 of the front lens or plate 7.

By suitable profiling of the dimples in the reflector 3, on the one hand and in the front lens or plate 7, on the other hand, the desired angle of divergence in the wide angle beam configuration can be selected.

Figure 2a shows the relatively shallow dimple in the front surface which is all that is necessary in order to provide for a 20° scatter upon diffusion of the beam at the

surface of the reflector 3. In practice, where the diameter of the dimple is  $2r$ , the solid radius of curvature of the dimple is  $11.5r$  in order to give the indicated  $20^\circ$  spread illustrated in Figure 2a. The height of each dimple is only 5 of the order of  $0.04r$ .

Figure 2b, on the other hand, shows that for refraction of the light at the front lens or plate 7, the more pronounced curvature of dimple of its front surface requires a radius of curvature of  $6.4r$ , and this time the 10 height of the dimple is  $0.14r$ .

It will of course be understood that any other configurations of dimple may be chosen in order to provide a different angle of divergence of the light in the floodlight configuration.

15 It is also envisaged that the dimple types may be designed so that the degree of optical divergence at the front lens or plate 7 may be different from that at the reflector 3, over the dimpled quadrants 8 and 5, respectively, for the purposes of generating alternative light 20 patterns.

Moreover, although Figures 2a and 2b show dimples on the front face of the reflector 3 and front lens or plate 7, other profiling to give the desired divergence may be used and may, by appropriate design, be formed on the rear 25 face of either element, if desired. Thus, a corresponding, concave, profiling on the rear face may be used, but the dimpled front surface is preferred.

The fact that the front lens or plate 7 is the only moving part in order to achieve the change in light patterns 30 from floodlight to spotlight, and vice versa, is convenient in that it is relatively straightforward to design a torch which is watertight but which has the necessary rotatable front lens or plate. Where strict waterproof quality of the torch is not required, some operating mechanism may be built 35 into the torch in order to allow the variation from floodlight to spotlight to be made with the same hand which is

holding the torch, thereby allowing the user of the torch freedom to use the other hand and arm for a different operation.

If desired, an additional front plate of planar or 5 domed configuration, but without dimpling, may be added in order to protect the dimpled front lens 7 against mechanical damage and/or corrosion and/or contamination in hazardous environments.

The dimples shown in the drawings may be replaced 10 by a series of concentric flutes having the same cross-section. A small element of each flute will only result in divergence of incident light in a plane at right angle to the flute at that point. However since each flute covers a full 90° the nett result will be the achievement of the 15 necessary divergence over the full extent of the beam. A reflector fluted in this way is shown in Figures 5a and 5b. A fluted lens plate will resemble the elevation shown in Figure 5b.

The dimensions of the flutes on the lens plate can 20 be such that the divergence achieved is different from that obtained from the flutes on the reflector. This will result in an asymmetric light distribution with the divergence in opposite quadrants different from that in adjacent quadrants.

25 Although conveniently the front plate 7 is a generally flat plate (with dimpled or fluted areas) as shown in Figure 1, it could instead be a meniscus lens with such dimpled or fluted areas.

The method of constructing the torch in accordance 30 with the present invention and of the optical elements thereof will be readily apparent to the expert in this art. Any modern known techniques may be used, and equally new techniques, as they are developed, can be applied in order to construct a torch in accordance with the invention.

35 In its simplest form, the torch may simply comprise the reflector 3 mounted for rotation relative to the bulb

holder 4 so that the angular orientation of the axis of the filament 2 with respect to the dimpled or fluted quadrants 5 of the reflector 3 can be modified. This will to some extent give the changeable light pattern which is optimised 5 in the embodiment described above.

The above described embodiments provide for a switching between a wide angled configuration of the beam and a "spot light" configuration. However, there may be certain applications in which a gradual transition from the 10 one extreme to the other may be required, and Figure 4 illustrates the currently preferred embodiment of the invention for achieving this gradual change.

The embodiment of torch 21 shown in Figure 4 includes a reflector 22 having a plurality of cylindrical 15 bores 23 therein and a flexible gas-impermeable film 24 bonded to the concave side of the generally parabolic reflector 22. The outer face (i.e. the upper face in Figure 4) of the film 24 is metallized to give it a reflective coating.

20 The dimpling illustrated in the embodiments of Figures 1 to 3 is, in Figure 4, achieved by applying a superatmospheric pressure to the interior of each of the bores 23 to cause the unsupported region 25 of the film spanning the bore 23 to bulge into the volume on the concave 25 face of the reflector 23. The magnitude of this superatmospheric pressure controls the curvature of the bulging of the film regions 25, and hence controls the degree of scatter of the beam from the "spot light" configuration towards the wide angle configuration.

30 In order to achieve the desired bulging of the regions 25 of the film, the reflector 23 is sealably held by its perimeter in a gasket 26 bonded to the internal surface of a generally cylindrical cup-shaped body 27. The cup-shaped body 27, or at least the floor 28 thereof, is of 35 flexible material so that an upward thrust indicated by arrow 29 in Figure 4 can decrease the volume defined between

the cup 27, 28 and the perforated reflector 22 to increase the pressure behind the film 24 and hence to increase the degree of bulging at 25 (i.e. to reduce the radius of curvature of the bulging and hence to provide dimples which 5 will give more scatter of the beam.

The mechanism for varying the degree of bulging in Figure 4 is purely schematically illustrated in that drawing and in practice other more sophisticated means may be provided and will be readily apparent to the expert in this 10 art.

The present invention thus provides one novel reflector such as the embodiment shown at 3 in Figure 1, and also the lens or plate, as in the embodiment shown at 7 in Figure 1, and also a lamp incorporating the reflector.

15 The invention thus provides a further embodiment of reflector having means for varying the configuration of dimpling on the concave face of the reflector, in this case by deforming the unsupported film regions 25.

In the above embodiments the reflector has some 20 segments profiled and the lens has others. As an alternative possibility, the lens may be protected by an outer panel, for example a further convex transparent plastic or glass plate, with the profiling formed on segments thereof so that the co-operating profiling can exist on the outer 25 protector and on the lens, allowing the reflector to be a non-profiled optimised surface.

C L A I M S

1. A lamp, comprising a reflector and a lens, wherein the light path includes reflection by or transmission through two members each having profiling which  
5 interrupts the face of the member and is able to diffuse the light along divergent paths, means being provided for establishing relative rotation between said two members to bring their respective profilings into and out of register.
2. A lamp according to claim 1, wherein one of  
10 the two members is the reflector.
3. A lamp including a reflector according to claims 2, and including means to rotate the reflector about its axis of symmetry, relative to a bulb holder adapted to receive a bulb having a filament extending transversely to  
15 the axis of symmetry of the reflector.
4. A lamp according to claim 1, wherein there is an additional transparent member through which light from the reflector passes before or after passing through the lens, and it is the lens and said additional member which  
20 include said profiling.
5. A lamp including a reflector according to any one of claims 1 to 4, and means for varying the profiling of said body of revolution.
6. A lamp according to claim 5 when appendant to  
25 claim 2 or 3, wherein said profiling varying means comprises a pressure chamber behind said reflector on a convex face thereof and means for deforming said pressure chamber to vary the configuration of said film spanning the bores in the reflector.
- 30 7. A lens or front plate for a lamp, divided into four segments with opposing segments profiled to diffuse the refracted light passing through the lens to give a divergent beam, and the two intervening segments without such profiling.

8. A lamp:- including a lamp holder for a bulb; a reflector surrounding said bulb holder and divided into four segments of which two opposing segments are profiled to diffuse light from the bulb being reflected by the reflector, and the other two segments being without such profiling; a lens or plate through which the light from the reflector passes, said lens or plate being divided into four segments corresponding to the segments of the reflector, two of said segments of the lens or plate being profiled to diffuse light passing therethrough to generate a divergent beam, and the other two intervening segments being without such profiling; and means allowing said lens to be rotated relative to the axis of symmetry of said reflector and relative to said reflector.

15 9. A reflector for a lamp, comprising a body of revolution having a concave face shaped to define an optical reflector, and profiling interrupting said concave face and able to diffuse the reflected light along divergent paths.

10. A reflector according to claim 9, wherein said 20 profiling is variable in shape for varying the degree of diffusion of the reflected light.

11. A reflector according to claim 10, wherein said 25 variable profiling comprises bores formed in the body of revolution and flexible reflecting means spanning said bores and means for deforming said flexible reflecting means to vary the extent to which said reflecting means differ in profile from the profile of said concave face of the reflector.

12. A reflector according to claim 11, wherein the 30 reflective means comprise a film bonded to the concave face of said body of revolution and coated with a reflective surface on the surface facing away from said body of revolution.

13. A reflector according to claim 9, wherein said 35 body of revolution is divided into four segments, with two opposed segments having said profiling to diffuse the

reflected light along divergent paths, and the two intervening segments without such profiling.

14. A reflector according to any one of claims 9 to 13, wherein the reflector is parabolic with a circular  
5 rim.

15. A lamp according to claim 3 or 8, a lens or plate according to claim 7, or a reflector according to claim 13 or 14, wherein said profiling comprises an array 10 of dimples in the respective segments, each dimple standing proud of the front surface of the lens or plate or of the reflector.

16. A lamp according to claim 3 or 8, a lens or plate according to claim 7, or a reflector according to claim 13 or 14, wherein said profiling comprises an array 15 of arcuate flutes in the respective segments, each arcuate flute standing proud of the front surface of the lens or plate or of the reflector.

17. A lamp according to claim 3 or 8, a lens or plate according to claim 7, or a reflector according to 20 claim 13 or 14, wherein the segments are all quadrants of a circle.

18. A lamp according to claim 17, wherein said means enabling the lens to be rotated comprise an actuating mechanism linked to a control on the exterior of the torch body.  
25

19. A lamp reflector substantially as hereinbefore described with reference to, and as illustrated in, Figures 1 and 2a, or Figure 4, or Figures 5a and 5b of the accompanying drawings.

20. A lens or plate for a lamp substantially as hereinbefore described with reference to, and as illustrated in, Figures 1 and 2b of the accompanying drawings.  
30

21. A lamp substantially as hereinbefore described with reference to, and as illustrated in, the accompanying drawings.  
35

## Relevant Technical fields

- (i) UK CI (Edition K ) F4R (RCAA; RCC)
- (ii) Int CL (Edition 5 ) F21V 13/06, F21L 15/02

Search Examiner

N JACOBS

## Databases (see over)

- (i) UK Patent Office
- (ii)

Date of Search

3 JUNE 1992

## Documents considered relevant following a search in respect of claims

1-6

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
	NONE	

SF2(p)

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Category	Identify of document and relevant passages	Relevant to claim(s)

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